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Exploring Literacy on the Internet

Reading comprehension on the Internet: Expanding our understanding of reading comprehension to encompass new literacies

Julie Coiro

The nature of literacy is rapidly changing as new technologies emerge (diSessa, 2000; Dresang & McClelland, 1999; Leu & Kinzer, 2000; Reinking, McKenna, Labbo, & Kieffer, 1998; Tapscott, 1998). "Today, the definition of literacy has expanded from traditional notions of reading and writing to include the ability to learn, comprehend, and interact with technology in a meaningful way" (Selfe cited in Pianfetti, 2001, p. 256). Electronic texts introduce new supports as well as new challenges that can have a great impact on an individual's ability to comprehend what he or she reads. The Internet, in particular, provides new text formats, new purposes for reading, and new ways to interact with information that can confuse and overwhelm people taught to extract meaning from only conventional print. Proficiency in the new literacies of the Internet will become essential to our students' literacy future (International Reading Association, 2001).

When observing students interacting with text resulting from an Internet search, Sutherland-Smith (2002) reported that they "perceive Web text reading as different from print text reading" (p. 664). Within Internet environments, many readers are easily frustrated when not instantly gratified in their rapid search for immediate answers and may adopt a "snatch and grab philosophy...not apparent in print text environments" (p. 664). Similarly, Eagleton (2001) observed middle school students with little experience with Internet inquiry often making "hasty, random choices with little thought and evaluation" (p. 3). These shallow, random, and often passive interactions with text are in direct contrast to the active, strategic, and critical processes of constructing meaning now being proposed by instructional leaders and supported by 25 years of reading research (Allington, 2001; Keene & Zimmermann, 1997; Robb, 2000).

I believe that important questions about reading comprehension on the Internet need to be addressed if teachers are to effectively prepare students for their literacy futures. In this column, I will closely examine the skills and abilities needed to interact with text on the Internet while exploring the answers to these four questions: Is the comprehension process different on the Internet? If so, what new thought processes are required beyond those needed to comprehend conventional print? Are these processes extensions of traditional comprehension skills, or do Web-based learning environments demand fundamentally different skills? If comprehension is different on the Internet, what implications do these differences have for comprehension instruction, assessment, and professional development?

Recent literature has addressed the need for changes in the way we think about reading comprehension as influenced by technology. In their new literacy and technology position statement, the International Reading Association (2001) suggested that "traditional definitions of reading, writing, and viewing, and traditional definitions of best practice instruction—derived from a long tradition of book and other print media—will be insufficient." This position statement recommends new strategies for students and teachers as they use new and varied forms of information and communication technology.

Researchers discussing the direction that reading research in comprehension is likely to take over the next two decades also recognize that "we live in a society that is experiencing an explosion of alternative texts" (RAND Reading Study Group, 2002, p. xiv) and that "electronic texts that incorporate hyperlinks and hypermedia introduce some complications in defining comprehension because they require skills and abilities beyond those required for the comprehension of conventional, linear print" (p. 14). Similarly, Spires and Estes (2002) described several cognitive and aesthetic challenges to

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comprehension presented by hypertext environments. In order to better prepare for these challenges, they described the need for a "rich theoretical description of the comprehension processes" (p. 123) involved in Web-based and electronic reading environments. It is this expressed need for clarification of the comprehension processes necessary for reading on the Internet that I intend to address here.

To explore the changing nature of reading comprehension, I draw upon a well-articulated model of reading comprehension outlined in the RAND Reading Study Group's report (2002). The authors of this report defined reading comprehension as "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language" (p. 11). They proposed a developmental heuristic of reading comprehension that includes three elements: "the reader who is doing the comprehending, the text that is to be comprehended and the activity in which comprehension is embedded" (p. 11). These three elements occur within the sociocultural context of the reader's classroom, home, and neighborhood, and they help a reader to interpret information and create personal meaning.

The main sections of this column on broadened understandings of text, the reading activity, the reader, and the social context—and the constructs described within each one—mirror the elements of the RAND Reading Study Group's heuristic of reading comprehension. However, I argue that the Internet forces us to expand our understanding of each of these elements by considering new aspects of comprehension that are clearly related to traditional comprehension areas (e.g., locating main ideas, summarizing, inferencing, and evaluating) but also require fundamentally new thought processes. The Internet provides opportunities for interacting with new text formats (e.g., hypertext and interactive multiple media that require new thought processes); new reader elements (e.g., new purposes or motivations, new types of background knowledge, high-level metacognitive skills); and new activities (e.g., publishing multimedia projects, verifying credibility of images, participating in online synchronous exchanges). Likewise, the Internet expands and influences the sociocultural context in which a reader learns to read by providing collaborative opportunities for sharing and responding to information across continents, cultures, and languages. I go on to illustrate how conventional understandings of the reader, the text, and the task are not always applicable in electronic and networked environments. Finally, I consider the implications of a broader definition of reading comprehension for instruction, assessment, and professional development.

Broadened understandings of text

The RAND Reading Study Group (2002) recognized features of conventional texts, such as varying genres, structures, reading levels, and subject matter that create potential challenges for readers. Electronic texts compound the challenges because they possess new characteristics that require different types of comprehension processes and a different set of instructional strategies. These new texts can be characterized as hypertextual networks that explore new types of story grammar and a variety of new formats (Goldstone, 2001; Reinking et al., 1998). Web-based texts are typically nonlinear, interactive, and inclusive of multiple media forms. Each of these characteristics affords new opportunities while also presenting a range of challenges that require new thought processes for making meaning. Let us explore each in more detail by examining a few online examples.

Nonlinear hypertext. A student visiting NASA's well-designed and popular children's informational website called StarChild: A Learning Center for Young Astronomers (http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html) is introduced to a different set of interactive features not available in conventional print. Most notable are the hyperlinks embedded within short passages about the solar system that encourage readers to navigate their own paths through the information in a nonlinear way that may be different than the path of other readers or the intended path of the author. This site enables each reader to actively engage with the text in ways that are personally relevant. However, new literacies are necessary to navigate the hyperlinks skillfully in ways that enhance comprehension. A reader must understand the advantages and disadvantages associated with having ultimate control of the direction in which text progresses and use inferential reasoning skills and context clues to discern one type of hyperlink from another.

On a typical page from StarChild's website (http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/solar_system.html) for example, at least five different types of hyperlinks are used. Within a passage about the solar system, one type of link leads you to a definition of the linked word within an alphabetical glossary on a separate webpage (e.g., *solar, orbit, astronomer*), and another link with the same visual features sends the reader to an entirely new passage about a completely different topic (e.g., the moon, the asteroid belt, the sun). A similar hyperlink found further down the page leads to a set of activities about the solar system, a fourth opens up an e-mail message addressed to the webmaster, and a fifth leads to NASA's security statement—a topic not necessarily important or appropriate for the elementary reader. Readers need a new type of inferential reasoning to anticipate these differences and decide whether or not each hyperlink will enhance or disrupt their search for meaning. "Never before has it been more necessary that children learn to read, write and think critically. It's not just point and click. It's point, read, think, click" (Tapscott, 1998, p. 63). Of course, once readers select any one of these hyperlinks, it is also assumed they will know how to return to the original text.

It is not my intention to criticize the design of this webpage—I think the information here is well designed and very age appropriate. Instead, I use it to illustrate the importance of (a) isolating the features of hyperlinked text that can confuse readers and (b) closely examining the thought processes necessary to use these features.

Multiple-media texts. Traditional text forms typically include a combination of two types of media: print and two-dimensional graphics. Electronic texts can integrate a range of symbols and multiple-media formats including icons, animated symbols, photographs,

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cartoons, advertisements, audio and video clips, virtual reality environments, and new forms of information with nontraditional combinations of font size and color (Brunner & Tally, 1999; Reinking & ChanLin, 1994). Images and sounds are combined with written texts to create new ways of conveying meaning, explaining procedures, and communicating interactively (Downes & Fatouros, 1995). For readers, these multimedia representations demand new ways of thinking about how to access, manipulate, and respond to information.

Students gathering information from the website entitled The Rainforest: People, Animals and Facts (http://www.christiananswers.net/kids/rainforest/home.html) are treated to colorful images, authentic animal sounds, and video footage—as long as they are competent in downloading various audio formats, manipulating the "buttons" on a digital video player, and interpreting the content of a photograph. Audio and video clips found at the Year of the Ocean (http://www.enn.com/yoto/multimedia) require strong listening skills (because the audio samples are not paired with visual images) and strategies for processing information gleaned from educational video footage. Particularly challenging are less familiar virtual reality environments like those found at PBS's Hidden New York: Virtual Reality (http://www.pbs.org/wnet/newyork/hidden/index.html). At this website, students can discover the hidden treasures in various corners of New York City—as long as they can maneuver the controls within a Quicktime Virtual Reality (QTVR) panorama complete with interactive hotspots and directional sound. For those equipped with these new literacies, the Internet provides exciting extensions of printed text. Without this expertise, readers may struggle even to access these multimedia representations, let alone be able to note details, interpret messages, and synthesize information communicated in multiple-media formats.

Interactive texts. In addition to the hypertext and hypermedia features, Web-based text environments are, by their very nature, interactive. Readers are invited to coauthor online texts as they navigate various paths and construct a personal adaptation of the information. Conventional texts, on the other hand, present information shaped by the author, and readers have little choice but to follow the author's intended plot or expository structure. Readers can choose to flip through the pages of a conventional text in a different order, but most are designed to be read in a linear fashion, and their features are not malleable. Goldstone (2001) noted that authors of postmodern texts have begun to function more as facilitators, inviting readers to construct their own story actively by "cobuilding the framework, supplying missing features of the story structure, and pulling together discrete narrative strands" (p. 366). Texts on the Internet become interactive environments as opposed to static words on a page. Digital texts also provide opportunities to interact with other people using embedded tools like electronic discussion boards and synchronous chat environments that, in turn, provide exposure to multiple and diverse perspectives. Finally, simple design tools enable readers to construct personal responses to information and publish them online to share with others.

Once again, new comprehension processes are required for these electronic text environments. With traditional texts, prereading thought processes focus on questions such as the following: What will happen next? What do I know about this topic? What is the author's purpose? What do I expect to learn from this text? Within interactive Web-based environments, however, proficient readers also need to plan answers to questions like these: How should I navigate this information? How can I expect to interact with this environment? What is my role or task in this activity? How can I add to this body of knowledge?

A reader visiting the UNICEF Voices of Youth Meeting Place (http://www.unicef.org/voy/meeting/meethome.html), for instance, should be prepared to deal with traditional and Web-based comprehension tasks. Traditional media formats (e.g., expository text, anecdotal narratives, photographs) provide readers with opportunities to learn more about current real-world issues like child labor, children's rights, war, discrimination, and urban life. In addition, this text is interwoven with invitations to post an opinion electronically, read personal responses from others, or become more involved with a particular issue and then share personal progress with others online. Comments are posted and translated into English, French, and Spanish to promote a global community of learners. Thousands of postings indicate that students are motivated to contribute their own ideas and efforts toward these authentic issues. If readers are literate in webpage design, they can publish personal responses to these interactions while becoming more socially aware.

Some students in the United States at a school in Massachusetts, for example, became involved in the campaign to end child labor by designing The Kid's Campaign to Build a School for Iqbal: A Bullet Can't Kill a Dream (http://mirrorimage.com/iqbal/index.html). This website documents their efforts to foster an awareness of child labor issues while raising funds to build a school for child workers in Pakistan in memory of Iqbal Masih, a former child laborer and activist who was murdered in 1995. Another example of an interactive forum on a similar topic can be found at iEARN's Fight Against Child Labor and Exploitation Project (http://www.iearn.org.au/clp), which provides "a place for youth to research issues of child labor, discuss issues, devise, develop and implement action agendas." The Project Index (http://www.iearn.org/projects/project_list.html) features more than 100 student-created projects inspired by the interactive nature of information on the Internet. As teachers, we must begin to include these interactions with technology in our repertoire of reader-response activities while considering the new literacies needed for readers to construct and share personal interpretations within Internet communities.

Broadened understandings of the reading activity

A second element in the RAND Reading Study Group's (2002) comprehension heuristic is the reading activity, which includes the purpose, process, and consequences of an activity. Internet-based comprehension tasks broaden our understanding of these elements because

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they present new purposes for reading, more critical thought processes during reading, and new examples of authentic responses after reading.

Purpose

Authors of the RAND Report noted that "when the teacher-imposed purpose is unclear to the learner, or in conflict with the learner's purpose, comprehension may well be disrupted.... Since the text is [potentially] difficult for students, teachers employ various instructional techniques that support reading" (RAND Reading Study Group, 2002, p. 26). The Internet offers a motivating medium for a Web-based instructional technique known as a WebQuest (Dodge, 1997). The WebQuest is a Web-based inquiry project that integrates research-supported comprehension instructional techniques (e.g., questioning, comparing, critically evaluating) with embedded links to current online resources. Well-designed WebQuests include explicit learning goals and a recommended process of inquiry. Student responses are guided by an open-ended rubric that leaves room for personal interpretation. By combining explicit supports with constructivist responses, teachers can increase the likelihood that externally imposed purposes are more closely aligned to those that are internally generated. (Visit http://www.sesd.sk.ca/teacherresource/webquest/webquest.htm for links to an extensive collection of WebQuests.)

In terms of new literacies, these Web-based inquiry projects demand fairly high levels of thinking and collaborative problem solving that may surprise readers used to more traditional reading tasks (e.g., answering literal-level questions and writing a summary book report) or even those who have previously explored the Internet by haphazardly searching for information. "The Quest has a purpose, a problem that reading can help to solve, and this puts reading and study in an entirely new light" (Spires & Estes, 2002, p. 118). Web-based inquiry projects extend traditional purposes for reading into new contexts. In these environments, students need to be prepared to adopt new roles (e.g., scientist, detective, reporter), follow certain paths with a particular purpose (as opposed to navigating their own path through hypertext or simply "surfing the Internet"), and work collaboratively to construct "an understanding of the material by creating something that others can respond to, on-line or off" (Dodge, 1997).

Process

"Processing the text involves, beyond decoding, higher-level linguistic and semantic processing and monitoring. [These typically include] skimming (getting only the gist of text) and studying (reading texts with the intent of retaining the information for a period of time)" (RAND Reading Study Group, 2002, p. 15). The nature of information on the Internet suggests new interpretations of these processes, which demand all readers to adopt a more critical stance toward texts or risk being unknowingly tricked, persuaded, or biased. Bill Chapman's Classroom Tools website (http://www.classroomtools.com) outlines strategies for helping students to validate online information and to recognize commercial propaganda and bias—three critical literacy skills that are vital to readers on the Internet. Parody websites like The Onion (http://www.theonion.com); HotAir (http://www.improbable.com); and fictitious reports about "California's Velcro Crop," "The Pacific Northwest Tree Octopus," and the reproductive cloning provider known as "Clones-R-Us" (from a collection compiled by Kathy Schrock at http://school.discovery.com/schrockguide/eval.html) are on the increase. This is another reason all readers need to be prepared to discern fact from opinion and truth from fiction. Again, the Internet poses different contexts for this aspect of literacy instruction.

Brunner and Tally (1999) outlined seven "key habits of mind" (p. 36) that help clarify how students should approach and process both traditional and new media. Critical questions that students should consider include the following: What particular perspective of reality is represented? What explicit or hidden values underlie this text? What media conventions are used in this text and how do they shape the way the information is interpreted? Who is the intended audience and how might different audiences interpret the text? Who owns the text and who benefits from it? Brunner & Tally concluded that

> helping students move from relatively passive absorption of information to habits in which they are able to frame arguments, consider evidence, and apply judgment creatively is key if we are to develop powerful and flexible thinkers capable of communicating about and solving difficult problems. (p. 35)

A second set of new comprehension processes on the Internet that builds on traditional research and summarizing skills involves the abilities to search, locate, and draw connections between resources of diverse and multiple perspectives. Electronic tools demand new literacies such as manipulating electronic databases, using multiple search engines, and navigating hierarchical subject guides. Like new media literacy skills, new search techniques are vital skills for us to teach as we strive to develop proficient readers in the future.

Consequences

The consequences of reading are also considered part of the reading activity and can include the knowledge that a reader has gained, the applications that a reader makes, and the level of engagement that a reader maintains while involved with a text (RAND Reading Study Group, 2002). These can all be considered consequences of reading on the Internet as well, but I believe that Web-based learning environments can foster opportunities for more diverse knowledge gains, more personal applications, and higher levels of engagement. Several Internet websites feature activities that increase visual, historical, and social awareness while also engaging readers to construct new bodies of knowledge from which others can benefit.

The Library of Congress's American Memory Historical Collection (http://rs6.loc.gov) and accompanying Learning Page (http://rs6.loc.gov/ammem/ndlpedu/index.html) provide lessons that guide students through a wealth of primary source documents, motion pictures, photographs, and sound recordings from U.S. history—a much wider range of multimedia information than is typically available in traditional history textbooks. The International Schools Cyberfair (http://www.gsn.org/cf), an international challenge in which students

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conduct research about their local communities and then publish their findings on the World Wide Web, fosters social and civic knowledge as well as a more personal understanding of diverse world communities. Thinkquest (http://www.thinkquest.org), now in its seventh year as an educational Web-development program, challenges teams of students or teachers in grades 3–12 to collaboratively design Web-based learning materials. As a result, over 5,000 websites have been created by students eager to contribute and publish information on the Internet. Finally, students in the state of Wisconsin have joined forces as Internet Detectives (http://www.madison.k12.wi.us/tnl/detectives) to build a student-generated library of evaluated Internet resources as a positive alternative to Internet filtering in their schools. These websites provide a small glimpse into the powerful consequences that the Internet has for students engaged in meaningful learning activities.

Broadened understandings of the reader

The RAND Reading Study Group (2002) reported that "proficient readers bring to the task of reading an array of capabilities and dispositions.... Such variables interact with one another and with the text to which the reader is exposed as determinants of performance on a given reading task" (pp. 19–20). If we expand our definition of text to include the features of digital texts as previously described, then we must also consider how these texts, and prior experiences with them, compound the variability in readers.

Cognitive capabilities

Sources of reading difficulties for many readers can be biological, instructional, or even environmental (Snow, Burns, & Griffin, 1998). Technology can influence our understanding of the cognitive traits commonly associated with both strong and struggling readers. Recently, computer-supported environments have been found to engage readers labeled "at-risk" or learning disabled in ways that "may help compensate for inadequate reading ability" (McKenna, Reinking, Labbo, & Kieffer, 1999, p. 113). Others are studying how supportive accessibility features and instructional prompts embedded within authentic sources of fiction and nonfiction can cause reading disabilities to virtually disappear (see CAST's Thinking Reader software at http://www.cast.org/about/index.cfm?i=2243).

Currently, few studies examine the use of the Internet as a teaching tool for reading comprehension, but I've found that CNN Learning Resources (http://literacynet.org/cnnsf) demonstrates the potential of Internet-based cognitive reading supports that help students make progress in comprehension. At this website, current news stories are accompanied by a range of multimedia interactive activities designed to support older students in their efforts to build reading comprehension skills. Audio recordings of the entire written text and short video clips related to the news stories support readers with stronger auditory tendencies, while accompanying interactive comprehension tasks provide practice and reinforcement in using new vocabulary, recalling and sequencing important details, drawing conclusions, and responding personally to a written work.

Ironically, many Web-based environments also introduce a new set of cognitive barriers that can cause competent readers of conventional text to be cognitively overloaded and emotionally frustrated (Delaney & Landow, 1991; Eagleton & Guinee, 2002). Hypertext and interactive features can offer too many choices and too many animations that may distract and disorient otherwise strong readers. Teachers need to be aware of these new cognitive challenges posed by Internet environments before we unnecessarily confuse our competent readers or overwhelm the struggling ones.

Purpose, motivation, and self-efficacy

Research shows that as children progress through school their interest in reading for pleasure and their motivation to read to learn diminish (Robb, 2000). Teachers can draw on technology applications, however, to engage students in challenging, authentic learning. A recent Software and Information Industry Association study shows that new educational technologies help "improve self-esteem and attitudes toward learning, especially when used in the context of collaborative learning activities" (Solomon, 2002, p. 19). Earlier in this column, I discussed collaborative Web-design response projects and authentic inquiry activities that attract students' interests while providing opportunities to apply critical reading and writing skills. Another impressive website that demonstrates technology tools being used to motivate and empower students from low-income neighborhoods in East Palo Alto, California, is known as Plugged In (http://www.pluggedin.org). Determined to ensure that all community members have the opportunity to benefit from technology use, Plugged In Enterprises trains teenage students in webpage design. Later, students take over in the business of creating websites for community organizations and commercial clients. As a result of access to these new technologies, students typically unmotivated and uninterested in applying their reading and writing skills are now choosing to engage in challenging, authentic learning tasks. Students respond to these tasks with confidence and appreciate that their experiences in the Plugged In program not only help them develop important literacy skills for school but also provide them with employment opportunities for the future.

Broadened understandings of the social context

"The three elements of reading comprehension—the text, the activity and the reader—occur within a larger sociocultural context" that influences how literacy learners interpret and transmit information (RAND Reading Study Group, 2002, p. xv). The RAND group report highlights the importance of reading comprehension as a social activity. Other researchers support the same notion (Gee, 2001; Rosenblatt, 1983; Tovani, 2000). Local technology tools and networked environments provide exciting new opportunities for social interaction and collaboration with others (Leu, 1996; Leu & Kinzer, 2000; Reinking et al., 1998). Immediate feedback from peers and opportunities for

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sharing with real global audiences can promote higher level thinking, communication skills, and deeper understandings of text.

Harris (2002) highlighted hundreds of "tele-collaborative" opportunities, integrated with K–12 curriculum-based learning activities requiring similar literacies, in her online book chapter entitled In the Kitchen: Designs for Telecollaboration and Telepresence (http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/Telecollaboration). Creativity and multicultural learning abound in online projects like Global Storytrain (http://storytrain.kids-space.org) and Writers' Window (http://english.unitecnology.ac.nz/writers/home.html), which encourage children and teens to join efforts to add their piece to the original stories published at these sites. Mrs. Silverman's Webfolio (http://www.kids-learn.org) has become a favorite starting place for teachers working with elementary students eager to include tele-collaborative exchanges in their repertoire of reader responses. With the proper amounts of scaffolding and support, young children can aspire to become future members of collaborative teams contributing Web-based learning materials for the Thinkquest program or International Schools Cyberfair (both mentioned earlier). These two competitions, and many other Internet projects, have brought together hundreds of thousands of students from over 80 countries to interact with new technologies such as synchronous information exchanges, online dialogue journals, real-time chats, electronic whiteboard exchanges, and videoconferences. Their published projects integrate many of the new literacies outlined in this column as extensions of our current understanding of reading comprehension.

As always, though, it is important to remember that while teamwork skills are vital to a student's success with tele-collaborative technologies, students and teachers vary in their interest and competence in collaborative learning tasks. In a list of reasons why tele-collaborative projects sometimes fail, Harris (2000) wrote that "tele-collaborative projects may be curriculum focused but they are most definitely people centered. Without effective collaboration, none would succeed" (p. 61). Similarly, Leu and Kinzer (2000) warned educators to pay special attention to learners accustomed to relying on independent learning strategies so that they do not approach new networked collaborative tasks with a negative perception. It is important to consider new instructional strategies that ensure tele-collaborative success for all students.

A broader model of reading comprehension—Educational implications

As I come to the end of this exploration beyond the RAND Reading Study Group's (2002) heuristic of reading comprehension, let me summarize answers to the questions I initially posed. I strongly believe that the comprehension process is different on the Internet, and I encourage you to follow the hyperlinks supplied here to experience firsthand the new opportunities and challenges offered in terms of new text elements, reader elements, activities, and sociocultural contexts. I believe that some tasks on the Internet ask readers to extend their use of traditional comprehension skills to new contexts for learning, while others, like electronic searching and tele-collaborative inquiry projects, demand fundamentally different sets of new literacies not currently covered in most language arts curriculums.

Given the changing nature of literacy texts and literacy tasks, it is not surprising, then, that these changes have important implications for our understanding of effective literacy instruction, assessment, and professional development. In terms of instruction, classroom teachers find the most success with technology when they engage their students in meaningful and authentic activities with open-ended software and the Internet (Jonassen, 2000). "When students create and share reports, Web pages, or digital presentations that require higher-order skills, they are empowered as learners and thinkers" (Solomon, 2002, p. 18). Our role, in fostering literacy learning with technology, often becomes that of facilitator, expertly guiding readers to appropriate online texts while taking advantage of the scaffolded learning supports embedded in many electronic environments. Modeling how to use strategies flexibly to solve different comprehension tasks becomes even more important as technologies rapidly change and new forms of literacy emerge.

With respect to assessment, historically, even conventional understandings of reading comprehension (e.g., constructs that don't address new technologies) have been difficult to assess, and some feel it is certainly time for a change in how we measure comprehension (Sarroub & Pearson, 1998). Wood (2000) wrote that "assuming we ever agree on a new definition of literacy [in the 21st century and beyond], how then will we measure literacy skills?" (p. 117). Because most instruction and assessment is currently driven by local and national standards, teachers in the United States can begin by urging literacy organizations to revise their language arts standards to more accurately reflect the influences of new technologies. I hope that we can begin to address more appropriately the explicit instruction of these new literacies and how to measure student progress and development in emerging text environments by expanding the constructs of the RAND Reading Study Group's (2002) definition of comprehension to include strategies needed for reading on the Internet.

Finally, these new literacies have implications for professional development in the area of effective reading with new technologies. To be most effective at modeling strategic reading behaviors, Pressley (2002) explained that it is imperative that teachers become more "aware of their own use of strategies" (p. 19). I would argue that the same holds true for teachers learning effective strategies for reading in digital and networked environments. Teachers must have opportunities to explore the Internet, experience online exchanges, and practice using the computer as a tool for learning. They should be more involved in planning for technology that promotes reading comprehension and should have access to ongoing technical support. Only then can they realize the full potential of computer technologies as a tool for literacy learning.

Within the walls of education, Wood (2000) described a "collision between two cultures...[namely] the literacy

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community with the techno-enthusiasts" (p. 122) and reported a hesitancy of adults to include digital text formats and tools in their repertoire of literary instructional strategies. Through the examples provided in this column, children have proven they are ready for technology and excited about the changes. We can no longer allow the fears of adults to dictate or confine the literacy needs and desires of the young readers and writers of our future. "Revolution is not restrained by the capabilities of the technology, but by our own imaginations and dedication to help provide guidance in the evolution of these new communication tools" (Boone & Higgins, 2001). In terms of literacy instruction in the 21st century, "The question of what to teach is accompanied by one just as urgent: how to teach" (Wood, 2000, p. 119). I believe that reading on the Internet is different, and our definition of reading comprehension needs to reflect those differences. Our job now is to envision new constructs of reading comprehension that introduce students to strategies for interacting with these new literacies. We must help students appreciate the distinctions of each one and also be willing to explore digital information environments together in more thoughtful ways.

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